

Studies of Swedish collembola.
With special reference to morphology,
taxonomy and alimentation

By

HÖGNI BÖDVARSSON

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HÖGNI BÖDVARSSON

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Introduction

The present paper is a brief summary of the studies of Swedish Collembola earlier published in two works (Bödvarsson 1970 a and 1970 b).

During my studies of South Swedish Collembola (Bödvarsson 1961), several interesting facts regarding these animals became evident. Among these are the following:

A group of seven species is so common and abundant that it may be regarded as forming a coherent net of animals extending through most soil types in Southern Sweden.

Great taxonomic problems exist among these species, especially in the forms *Onychiurus armatus* (Tullb.) and *Folsomia quadrioculata* (Tullb.). Because of the great abundance of the species these taxonomic problems are of great practical as well as theoretical interest.

The great abundance of the above mentioned seven species indicates that they may play a considerable part in the development and condition of the soils in which they live.

The above mentioned circumstances have been the starting point of the present studies. These may be regarded as a continuation and further development of my studies of 1961. I wished to investigate further the points mentioned above. This has resulted in the following studies of *Onychiurus armatus* and *Folsomia quadrioculata* with special reference to morphology and taxonomy, and the "Alimentary studies of seven common soil-inhabiting collembola of Southern Sweden". The last named work is an attempt to cast some light on the soil-biological importance of the most common species with respect to their feeding habits. Their great abundance already indicates some importance.

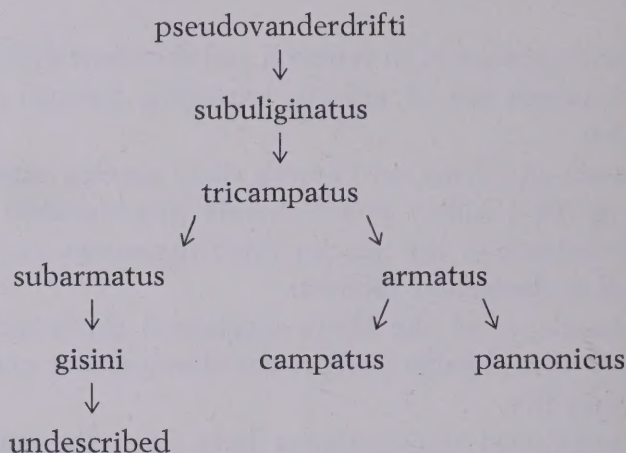
Studies of *Onychiurus armatus* (Tullberg)

The occurrence and variation of 65 characters in a material of 513 specimens belonging to the *Onychiurus armatus* group were studied. Of these characters, 31 are introduced and studied for the first time in this work.

Because of their general use in the taxonomy and systematics of the *Onychiuridae*, the pseudocelli were studied very carefully and extensively. These studies gave several interesting results: All forms which have been described within the *armatus* group can be derived from one another through small gradual changes in their morphology. These changes are most often a reduction of a pair of pseudocelli on some body segment or some other kind of reduction of characters. This system of reductions led to a kind of "genealogical table" where all the forms trace their origin to the two "ancestors" *pseudovan-*

derdrifti and *mediovanderdrifti*. This result is corroborated by the result of the other studies of the present work.

The present material could be divided into nine groups according to the number of pseudocelli (pseudocellar groups). The variations in the number of pseudocelli on different body segments within the nine pseudocellar groups (forms) show transitions from one form to the other. These transitions suggest the following lines of derivation from *pseudovanderdrifti*:



The studies of the length characters have led to the construction of a three-dimensional model showing the relative morphological distances between the nine forms of the material. These relative morphological distances may be adapted, in a logical way, to most of the meristic characters with pronounced variation (the others are more or less constant), and also to the lines of derivation of the pseudocelli. The forms of the *armatus* group studied in the present work thus cohere in a most intimate way by a series of continuous small morphological changes.

The arrangement of the four bristles dorsally on abd. VI (the so-called pre-spinal bristles) has been shown to be dependent on the size of the anal spines. Several morphological phenomena not described in the literature and some abnormalities in the anal spines and other body parts are described. Several examples of intermediate specimens showing a combination of characters from more than one species description are described.

Studies of the accompanying collembolan fauna of the nine forms of the material show that there are certain differences between the forms *pseudovanderdrifti* and *armatus* that may indicate some slight degree of ecological difference between these two.

The forms of the *armatus* group here treated have been regarded as distinct species (above all by H. Gisin). The results obtained are that this opinion is not valid. The forms of *Onychiurus armatus* found in the present material must be considered as being of an infrasubspecific nature, in accordance with my work

of 1959. One form, not corresponding to any existing description, has accordingly been called *O. armatus f. scanica*.

Studies of *Folsomia quadrioculata* (Tullberg)

Two samples of *Folsomia quadrioculata* (Tullberg), consisting of 100 and 101 specimens respectively, have been studied with respect to 37 characters, whereof 29 were length measurements and 8 meristic characters. In addition, observations were made of colour shade, the development of the sexual orifice and sex.

The two populations are practically identical with respect to their morphology on all examined points with the exception of size, bristle length and colour shade. These discrepancies may be explained on the basis of the fact that a large proportion of the one population (K-40) consists of young individuals with incomplete sexual orifices. This population contains individuals that with respect to bristle length on abd. IV-VI (the only quantitative character which permits a division of the material into distinct groups) show all transitions between the forms *Folsomia manolachei* Bagn., *F. nana* Gisin and *F. quadrioculata* (Tullb.). All meristic characters that do not coincide in both populations show a weaker development in the smaller, darker, more short-haired animals. This leads to the conclusion that these in fact belong to a young generation of individuals of the same species as the larger, lighter and more long-haired individuals. This, in turn, means that the forms *Folsomia nana* Gisin and *F. manolachei* Bagn. must be regarded as synonyms of *F. quadrioculata* (Tullb.).

Alimentary studies of seven common soil-inhabiting collembola of Southern Sweden

The gut contents, amount and several ingredients, have been studied in seven of the commonest soil-living collembola in Southern Sweden.

Between 20.6 and 51.5 per cent of all observed specimens of the different species have no gut contents at all. The possibility that the gut contents are not visible in the lactic acid mounts is discussed. Another possibility is that the gut was emptied in connection with moults.

The distribution of the gut contents among the different body segments was studied. With the help of these studies it was possible to obtain an approximate expression for how great a part of all the guts of the population is filled. The percentage of individuals with filled guts varies between 31.3 and 52.5. It may be concluded from these studies that some species (e.g. *Folsomia quadrioculata*) eat more sporadically than others (e.g. *Isotoma notabilis*).



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It was also concluded that deep-living species more often have filled guts than those that live nearer the surface. This is very probably due to their food being qualitatively inferior to the food of the others. Greater quantities must therefore be treated in the guts of the deeper-living species. This must be of certain significance to the soil-biological importance of the different species.

Fungal hyphae do not seem to be so common an ingredient of the food of the collembola species which have been examined as the statements of the literature seem to indicate. A considerable proportion of the animals with gut contents, between 12.6 and 71.1 per cent, have no fungal hyphae at all in their guts. It appears as if the amount of fungal hyphae eaten varies with the depth at which the different species tend to live, and inversely with the amount of ingested food. This indicates, in my opinion, that fungal hyphae are the most valuable ingredient of the food of these species. Spores, pollen grains and exuvia are of minor importance.

Mineral particles are common ingredients in the gut and this indicates that these species contribute in considerable degree to the transport of minerals in the soil.

Amorphous mass, consisting for the most part of unidentifiable material, is almost always a conspicuous ingredient of the gut contents.

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References

- BÖDVARSSON, H. 1959: Studien über die Variation einiger systematischen Charaktere bei *Onychiurus armatus* (Tullberg, 1869) (Collembola). Opusc. Ent. 24: 225-245. Lund.
- 1961: Beitrag zur Kenntnis der südschwedischen bodenlebenden Collembolen. Opusc. Ent. 26: 178-198. Lund.
- 1970 a: Alimentary Studies of Seven Common Soil-inhabiting Collembola of Southern Sweden. Ent. scand. 1: 74-80. Lund.
- 1970 b: Studies of *Onychiurus armatus* (Tullberg) and *Folsomia quadrioculata* (Tullberg) (Collembola). With special reference to morphology and taxonomy. Opusc. Ent. Suppl. 36. Lund.